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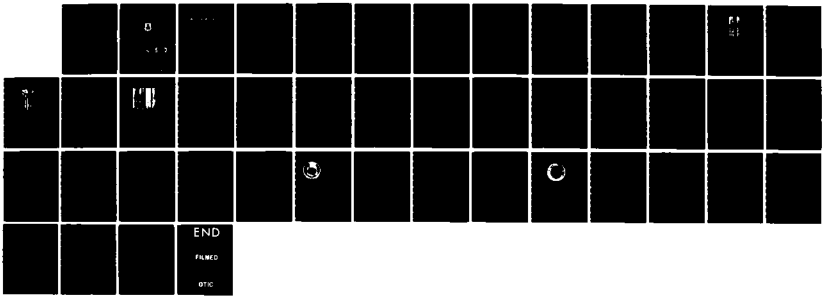

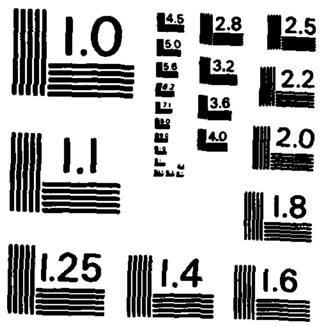
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FOREIGN TECHNOLOGY DIVISION

MATERIALS OF THE FOURTH SCIENTIFIC-TECHNICAL
CONFERENCE ON QUESTIONS OF THE EXTRUSION
OF METALS

(Selected Articles)

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UNEDITED MACHINE TRANSLATION

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MATERIALS OF THE FOURTH SCIENTIFIC-TECHNICAL CONFERENCE ON QUESTIONS OF THE EXTRUSION OF METALS (Selected Articles)

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U. S. BOARD ON GEOGRAPHIC NAMES TRANSLITERATION SYSTEM

Block	Italic	Transliteration	Block	Italic	Transliteration
А а	*А а*	A, a	Р р	*Р р*	R, r
Б б	*Б б*	B, b	С с	*С с*	S, s
В в	*В в*	V, v	Т т	*Т т*	T, t
Г г	*Г г*	G, g	У у	*У у*	U, u
Д д	*Д д*	D, d	Ф ф	*Ф ф*	F, f
Е е	*Е е*	Ye, ye; E, e*	Х х	*Х х*	Kh, kh
Ж ж	*Ж ж*	Zh, zh	Ц ц	*Ц ц*	Ts, ts
З з	*З з*	Z, z	Ч ч	*Ч ч*	Ch, ch
И и	*И и*	I, i	Ш ш	*Ш ш*	Sh, sh
Й й	*Й й*	Y, y	Щ щ	*Щ щ*	Shch, shch
К к	*К к*	K, k	Ъ ъ	*Ъ ъ*	"
Л л	*Л л*	L, l	Ы ы	*Ы ы*	Y, y
М м	*М м*	M, m	Ь ь	*Ь ь*	'
Н н	*Н н*	N, n	Э э	*Э э*	E, e
О о	*О о*	O, o	Ю ю	*Ю ю*	Yu, yu
П п	*П п*	P, p	Я я	*Я я*	Ya, ya

*<u>ye</u> initially, after vowels, and after ъ, ь; <u>e</u> elsewhere.
When written as ё in Russian, transliterate as yё or ё.

RUSSIAN AND ENGLISH TRIGONOMETRIC FUNCTIONS

Russian	English	Russian	English	Russian	English
sin	sin	sh	sinh	arc sh	$\sinh^{-1}$
cos	cos	ch	cosh	arc ch	$\cosh^{-1}$
tg	tan	th	tanh	arc th	$\tanh^{-1}$
ctg	cot	cth	coth	arc cth	$\coth^{-1}$
sec	sec	sch	sech	arc sch	sech^{-1}
cosec	csc	csch	csch	arc csch	csch^{-1}

Russian	English
rot	curl
lg	log

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MATERIALS OF THE FOURTH SCIENTIFIC-TECHNICAL CONFERENCE ON QUESTIONS OF THE EXTRUSION OF METALS.

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SPECIAL FEATURES OF THE PROCESS OF THE EXTRUSION OF HEAT-RESISTANT ALLOYS DIFFICULT TO SHAPE.

G. I. Taranenko, Yu. V. Manegin.

As a result of nonuniformity of outflow during extrusion/pressing in peripheral layers of metal being deformed at output from deformation area appear tensile stresses. During the extrusion/pressing of such low-plasticity materials as the hard-to-deform heat-resistant nickel base alloys, tensile stresses can lead to the destruction of molded article. Therefore during the selection of the technological parameters of the extrusion/pressing similar materials it is necessary to attempt to accomplish/realize deformation in such a way that the value of tensile stresses would be minimum.

In examination of character of distribution of rates of displacement/movement of different layers of metal in deformation area it is evident that rate of central layers at output from eyelet of die is equal to discharge velocity of metal - v_{ucm} (Fig. 1). However, peripheral layers in this case move with a lower speed of

and the trajectory of their motion composes with the axis/axle of extrusion/pressing the angle, equal to the angle of matrix/die.

At moment of output of metal from deformation area alignment/levelling rate of its layers over section/cut occurs. In this case the rate of peripheral layers changes intermittently to magnitude of vector $v_{ск}$ (see Fig. 1). Expanding $v_{ск}$ on components directed along (V_1) and across (V_2) axis, it is possible to see that the value of tensile stresses depends on V_1:

$$v_1 = v_{ист} - v_{пер} \cdot \cos\alpha. \qquad (I)$$

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Utilizing data of work [1], expression (1) can be recorded as follows:

$$v_1 = v_{пр} \cdot \mu \left[I - \frac{\cos\alpha_1 \cdot \cos\alpha}{\cos(\alpha - \alpha_1)} \right], \qquad (2)$$

where $v_{пр}$ - rate of extrusion/pressing;

μ - total draw ratio;

α_1 - central angle, which determines position of boundaries/interfaces of deformation area.

As it follows from expression (2), value V_1 is directly

proportional to rate of extrusion/pressing, to draw ratio and grows/rises with increase in angle of matrix/die and curvature of boundaries/interfaces of deformation area.

On the basis of analysis of expression (2) it is possible to make following conclusion: for reducing/descending value of tensile stresses extrusion/pressing wrought alloys must be carried out with least possible speed; rate of extrusion/pressing one should lower with an increase in degree of deformation.

Conclusions indicated are confirmed by experimental data on extrusion/pressing of hard-to-deform heat-resistant alloy on nickel basis EP 109 (Fig. 2). In this case with the same temperature of extrusion/pressing 1120°C and constant coefficient of drawing $\mu=4$ an increase of the rate from 30 to 80 mm/s leads to the appearance of surface defects/flaws in the form of transverse strains.

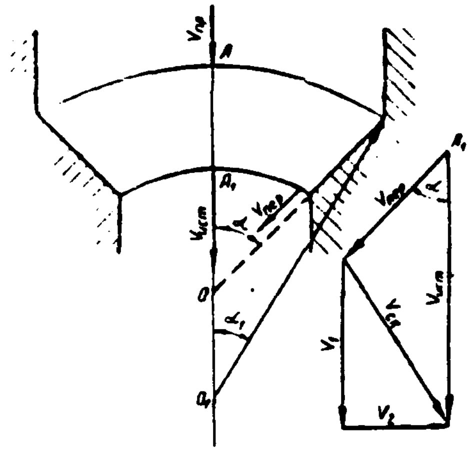

Fig. 1. Diagram of the alignment/levelling the discharge velocities of metal at the output from the deformation area.

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It is possible to attain a decrease of nonuniformity of metal flow by use of matrices/dies with small angle of approach cone and by smooth transition/transfer from conical part to calibration band [2, 3].

Fig. 3 presents type of surface of rods from alloy EP 109, pressed at temperature $T_{\text{нагр}} = 1090^\circ C$ with coefficient of drawing $\mu=4$ on dies with angle of approach cone of $2\alpha=60^\circ$, to 90°, 120° and 180° and by radius transition of 10 mm.

Rods with satisfactory quality of surface were obtained on matrices/dies with angle of approach cone of 90° and 120°. On the surface of the rod, pressed on the matrix/die with $2\alpha=60°$, toward the end of the extrusion/pressing insignificant cracks appeared; their formation can be explained by the fact that in the matrices/dies with small angles the conditions of retaining/preserving/maintaining the lubrication in the deformation area deteriorate. On the surface of the rod, pressed on the matrix/die with $2\alpha=180°$, appeared rough cross cracks, that it was connected with considerable tensile stresses.

Fig. 2. Type of the surface of the pressed rods from the alloy EP 109 (temperature of 1120°C; μ=4; 2α=120°C): a) v_{np} =30 mm/s; b) v_{np}=80 mm/s.

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Nonuniformity of metal flow depends substantially on presence of lubrication in deformation area. During the extrusion/pressing of the hard-to-deform alloys the specific pressures are high and the deformation rate low, which determines the specific character of working conditions of lubrication. In this case should be applied the glass lubricants with the higher coefficients of viscosity/ductility/toughness, than during the extrusion/pressing of

carbon and alloy steels [4]. The results of the extrusion alloy EP 109 with the use for the washers of glasses by viscosity/ductility/toughness (η) 200, 500, 1500 and 3000 poises confirmed this assumption (Fig. 4). The use/application of glass lubricants with viscosity/ductility/toughness 200, 500 and 1500 poises did not ensure obtaining good-quality articles. This is explained by the fact that already in the beginning of extrusion/pressing the lubrication was squeezed out of the deformation area and all subsequent extrusion/pressing occurred without the lubrication. Only during the use of a glass lubricant by viscosity/ductility/toughness 3000 poises the quality of the surface of the pressed rods was satisfactory.

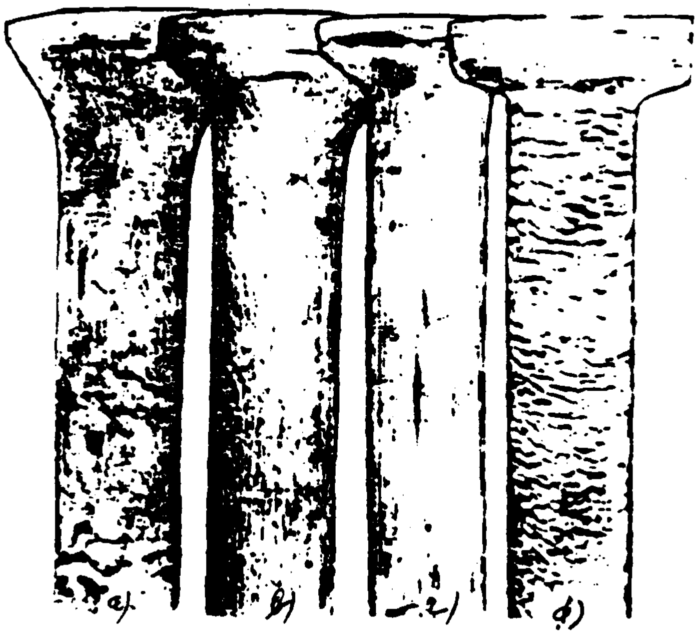

Fig. 3. Type of the surface of the pressed *rods from* the alloy EP 109 during the extrusion/pressing on the matrices/dies with the different value of the angle of approach cone (T=1090°C; μ=4; $v_{пр}$ = [illegible] mm/s): a) 2α=60°; b) 2α=90°; c) 2α=120°; d) 2α=180°.

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It is known that hard-to-deform heat-resistant nickel base alloys possess high plasticity in very narrow temperature interval. For the alloy EP 109 this interval, for example, corresponds to temperatures of 1140-1170°C [5]. Since the zone of output from the deformation area is the most dangerous zone during the

extrusion/pressing, the end of process should be carried out at a temperature of the maximum plasticity of malleable alloy. this condition can be recorded as follows:

$$T_{\text{мин}} \leq T_{\text{вых}} \leq T_{\text{макс}}, \qquad (3)$$

where $T_{\text{мин}}$ - temperature, which corresponds to lower boundary of the interval of plasticity;

$T_{\text{макс}}$ - temperature, which corresponds to upper boundary of the interval of plasticity;

$T_{\text{вых}}$ - temperature of peripheral layers of article at the output from the deformation area.

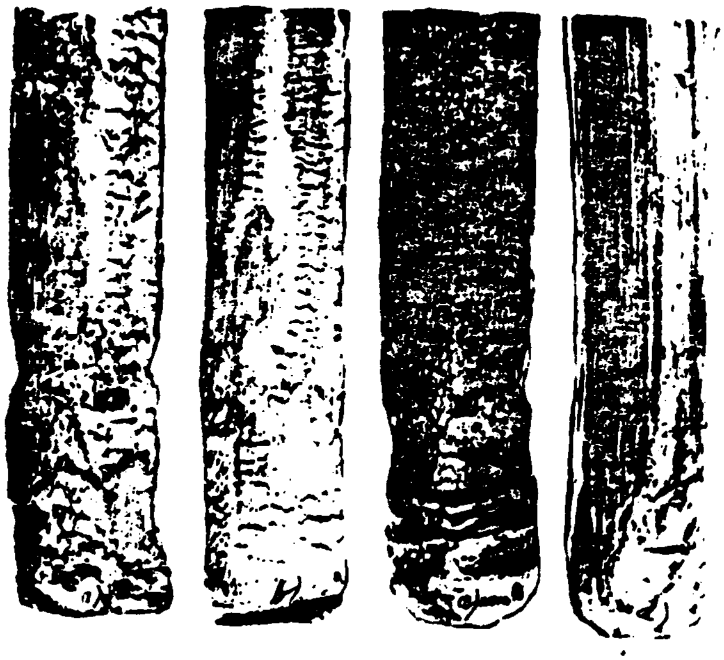

Fig. 4. Type of the surface of the rods from the alloy EP 109, pressed on the washers from the glass lubricants of different viscosity/ductility/toughness ($T=1090^{\circ}C$; $m=4$; $2\alpha=120^{\circ}$; $V_{np} = 30$ mm/s): a) $\eta=200$ poise; b) $\eta=500$ poise; c) $\eta=1500$ poise; d) $\eta=3000$ poise.

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As is known, for process of hot pressing became characteristic considerable heat losses in peripheral layers before extrusion/pressing and high heating of metal as a result of work of deformation. These factors must be considered especially during the extrusion/pressing of alloys with the narrow temperature interval of

plasticity. In this case condition (3) can be recorded in the following form:

$$T_{мин} \leq T_{вых} = T_{нагр} - \Delta t_1 + \Delta t_2 - \Delta t_3 \leq T_{макс}, \qquad (4)$$

where $T_{нагр}$ - temperature of heating blanks in the furnace;

Δt_1 - heat losses in the blank for the time of intermediate operations from the moment of output from the furnace to the entry of metal into the deformation area;

Δt_2 - thermal effect;

Δt_3 - heat losses in the metal in transit through the deformation area.

To change heat balance during extrusion/pressing for purpose of retention/preservation/maintaining condition (4) is possible only by way of change $T_{нагр}$ and Δt_1.

Change in $T_{нагр}$ does not cause practical difficulties, but for change Δt_1 is necessary use/application of special measures, which should be considered during development of technology of extrusion/pressing low-plasticity materials. By such measures are heating in the glass lubricant, transportation from the furnace to the press in heated container, etc.

During extrusion/pressing of a number of heat-resistant alloys EP 109, EP 220, ЭИ-827, ЭИ-929, etc.), carried out in TsNIIchermet with application of measures indicated, are obtained good results.

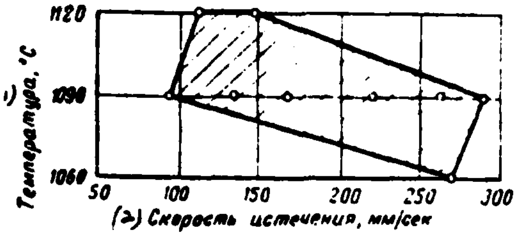

Fig. 5. Temperature-velocity region of the extrusion/pressing alloys EP 109 and EP 220.

Key: (1). Temperature, °C. (2). Discharge velocity, mm/s.

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Under all other optimum conditions there is clearly expressed connection/communication between basic technological parameters: with heating temperature, with rate of extrusion/pressing and with degree of deformation. The interconnection between these parameters for each type of alloy must be determined experimentally.

Example to established/installed interconnection between basic parameters of extrusion/pressing is graph, on which is represented dependence of temperature of extrusion/pressing on discharge velocity of metal during extrusion/pressing of alloys EP 109 and EP 220 (Fig. 5). Each point of the region, outlined on this graph, corresponds to

temperature and discharge velocity, at which is possible the realization of the process of extrusion/pressing without the decomposition of metal. The sizes/dimensions of this region for different alloys will be determined by their properties.

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STUDY OF LAWS GOVERNING THE METAL FLOW WITH EXTRUSION INTO THE TWO-CHANNEL DIES.

G. G. Rutman, G. Ya. Gun, P. I. Polukhin.

Implementation of multichannel extrusion/pressing in number of cases will make it possible to increase productivity of presses and to decrease production wastes. The study of this process consists in the establishment of the possibilities of the alignment/levelling the discharge velocities of articles.

It is known [1, 2], that rates of flow of metal depend on relationship of sizes/dimensions of matrix channels, their form and arrangement, size/dimension and form of working collars of matrix/die, and also on flow properties of material under conditions of its shaping and state of contact surfaces (friction).

For mathematical description of studied process quantitative data are necessary. While conducting of investigation it was necessary to determine the effect, which the relationship/ratio of the areas of the holes of channels and the form of their cross

sections exert to the finite length of the articles pressed into two channels. A series of flat two-channel dies (without the working collars) was designed and manufactured.

Total area of holes of channels, their mutual arrangement and distance from axis/axle of extrusion/pressing for all matrices/dies were constant/invariable (Fig. 1). Lead blanks with diameter of 90×100 mm pressed in the testing machine ПММ-500, equipped with general-purpose device for the direct and reverse/inverse extrusion.

In this case in oscillogram every 10 mm of way, passed noted by pressed articles. The measurement of instantaneous length of articles in the process of extrusion/pressing was accomplished/realized with the aid of the devices, placed directly at the output from the die. The system of springs provided the continuous compression of the framework with the roller to the moving/driving article.

During interpretation of oscillograms calculated relations of time intervals, in which articles passed equal ways. In this case the disagreement of results for one extrusion did not exceed 1-1.5% (rate of extrusion/pressing it oscillated from 60 to 65 mm/min).

Results of variance analysis, carried out for case of two-factor (area ratio, form of holes) experiment with fixed/recorded and random

levels [3], showed that portion of dispersion, connected with random error, composed 8.25%.

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The effect of form is statistically trivial, but it at the same time occupies the specific part of the general/common/total dispersion - 18.6%.

Curve, which characterizes change in velocity ratios for bar profiles/airfoils, is approximated well by simple hyperbolic dependence (Fig. 2). To it corresponds the linear approximation of dependence for the relations of the flows of metal, which escape/ensue from holes, the so-called current volumes. From these relations the change represented in Fig. 3 in the portion of the total flow through each hole follows.

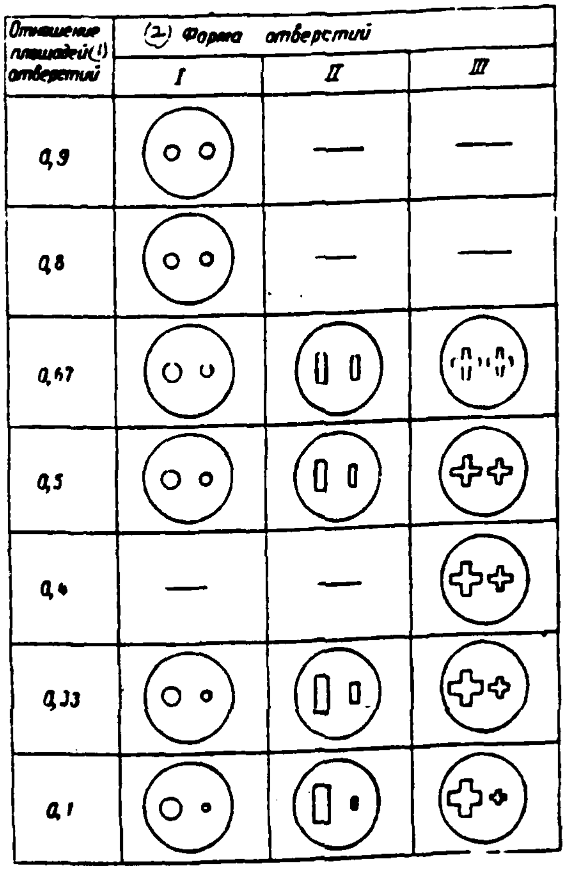

Fig. 1. Area ratio and the form of the holes of the channels of the manufactured matrices/dies.

Key: (1). Ratio of the areas of holes. (2). Form of holes.

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Moreover for the twofold difference of the areas of holes 32% of

total flow enter smaller, 68% - into the larger hole of the channels of matrix/die.

Curves, which characterize change in rates of flow of metal through each hole, are shown (Fig. 4) that linearity curved."ratio of flows - ratio of areas" is retained as a result of considerable change in discharge velocity of smaller opening and its very low change of larger (not more than 10%).

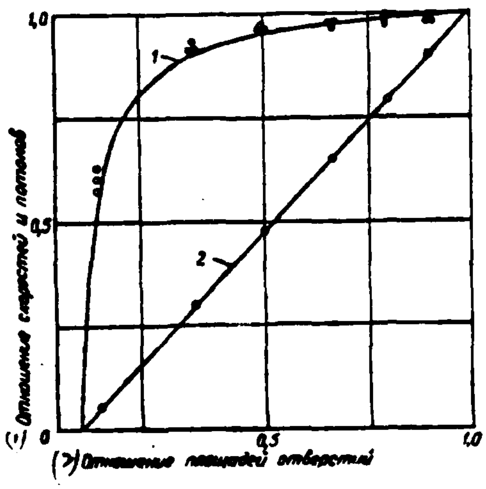

Fig. 2.

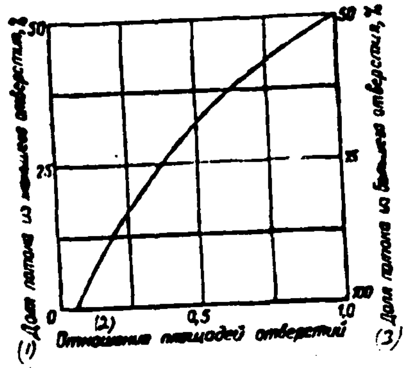

Fig. 3.

Fig. 2. Dependence of ratio of velocities (1) and flows (2) during manufacture of bar profiles/airfoils on ratio of areas of holes.

Key: (1). Ratio of velocities and flows. (2). Ratio of areas of holes.

Fig. 3. Change in portion of total flow through each hole.

Key: (1). Portion of flow of the smaller hole, %. (2). Ratio of areas of holes. (3). Portion of flow of larger hole, %.

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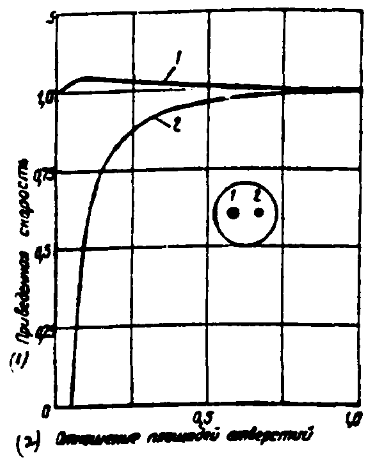

Fig. 4. Change in the rate of flow of netal during the fabrication of rod-shaped profiles in respect to channels (1, 2).

Key: (1). Reduced velocity. (2). Ratio of areas of openings.

Carried out experiments are part of study program of special features/peculiarities of kinematics of process of extrusion/pressing for purpose of development of methods of calculation of matrix instrument.

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APPLICATION OF HIGH-TEMPERATURE ALLOYS FOR MANUFACTURING OF DIES.

R. P. Izakov, A. V. Korobkov.

In recent years technology of manufacture of ducts/tubes/pipes, rods and profiles/airfoils from alloys on copper basis with those increased by strength and resistance to deformation and high temperature of extrusion/pressing (900-950°C) is developed and introduced at plants for working of nonferrous metals.

Hot pressing causes intense wear of working surfaces of instrument, which works at high temperatures and considerable specific pressures. Under similar conditions the available constructions/designs of the matrices/dies, made in essence from steel 3X2B8Ф, cannot ensure the constancy of the geometry of working surface during the extrusion/pressing and, consequently, also stay-put feature in molded article. Die steels of new brands/marks according to their properties exceed steel 3X2B8Ф only insignificantly.

Low durability of matrices/dies made of steel 3X2B8Ф is caused by following:

1) temperature of contact surface of die with heated metal is established/installed instantly and does not change during entire process of contact;

2) as a result of deformation of pressed metal is liberated additional heat;

3) *under action of forces of friction between matrix/die and* pressed metal is separated certain quantity of heat.

Consequently, surface layers of matrix/die in specific quantity of molding cycles are heated to temperature of extrusion/pressing. But at a temperature higher than 600°C steel 3X2B8Ф sharply decreases its strength properties.

Use/application of alloy ЭИ661 for manufacturing matrices/dies did not ensure good results. The authors carried out experiments on the manufacture of matrices/dies from the high-temperature (strength) alloys ЭИ787, ЭИ867, ЭИ437БУ. The mechanical properties of these alloys are given in the table[1].

FOOTNOTE [1]. F. F. Khimushin. High-temperature (strength) steels and alloys, M., publishing house "Metallurgy", 1964. ENDFOOTNOTE.

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Mechanical properties of high-temperature (strength) alloys.

(1) Марка сплава	(2) Температура испытания, °С	$\sigma_в$, (3) кГ/мм²	σ_s, (3) кГ/мм²	δ, %	ψ, %	(3) $a_к$, кгм/см²	(4) Режим термической обработки
ЭИ787	20 700	I28,3 97,8	82,5 -	2I,9 I0,4	32,4 I5,2	I0,4 7,6	(5) Закалка с I080°С, выдержка 8 час; охлаждение на воздухе; старение при 750°С, выдержка I6 час; охлаждение на воздухе.
ЭИ867	20 900	95 60	70 43	6 I0	8 I2	I,5 -	(6) Закалка с I220°С, выдержка 6 час; охлаждение на воздухе; старение при 750°С; выдержка 8 час; охлаждение на воздухе.
ЭИ437БУ	20 800	I00 52	65 43	20 I2	2I 30	5 -	(7) Закалка с I080°С; выдержка 8 час; охлаждение на воздухе; старение при 700°С, выдержка I6 час; охлаждение на воздухе

Note. Mechanical properties at high temperatures are indicated during the short-term tests.

Key: (1). Brand/mark of alloy. (2). Temperature of testing, °C. (3). kg/mm². (4). Mode/conditions of heat treatment. (5). Hardening with 1080°C, holding 8 hour; cooling in air; aging with 750°C, holding 16 hour; cooling in air. (6). Hardening with 1220°C, holding 6 hour; cooling in air; aging with 750°C; holding 8 hour; cooling in air. (7). Hardening with 1080°C; holding 8 hour; cooling in air; aging with 700°C, holding 16 hour; cooling in air.

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Steel ЭИ787 is tested/experienced on matrices/dies of press with effort/force 1500 t of containers with diameter of 155 and 180 mm and press by effort/force 3000 t of containers with diameter of 205 and 255 mm during extrusion/pressing of copper, German silver, alloy МНЖ5-1 and brasses Л-62, ЛЖМЦ59-1-1, ЛО-70-1. During testing of this steel is established/installed the following:

1. On the press with force 1500 t durability of the dies between regrindings during the extrusion/pressing of copper МНЖ5-1 composed from 35 to 200 molding cycles, general/common/total durability - 600 molding cycles. Matrices/dies get out of order due to the appearance and rapid development of radial cracks (Fig. 1).

Low durability of matrices/dies is caused by high specific pressures (50-86 kgf/mm²) during extrusion/pressing of ducts/tubes/pipes with diameter of 35-40 mm from container with diameter of 155 mm at high temperature of extrusion/pressing (900-950°C).

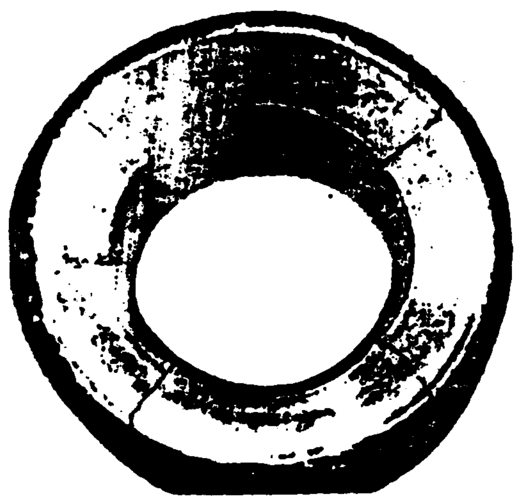

Fig. 1. Matrix/die made of steel ЭИ787 after extrusion/pressing.

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2. During extrusion/pressing on press by effort/force 3000 t of container by diameter of 205 mm of German silver bolts with diameter of 88 mm durability of matrices/dies composed 40-100 molding cycles, ducts/tubes/pipes diam. 45×60 mm from alloy ЛО-70-1 - 250 molding cycles, rods diameter of 60 mm from alloy ЛЖМЦ59-1-1 - 60 molding cycles.

3. During extrusion/pressing on press by effort/force 3000 t from container by diameter of 255 mm of ducts/tubes/pipes diam. 110×120 mm and 110×123 mm of alloy МНЖ5-1 durability of matrices/dies

composed 90-150 molding cycles. On the working surface of matrices/dies after 30 molding cycles appear the fine/small radial cracks, which then grow.

Steel ЭИ787 is suitable for extrusion/pressing of copper, alloy МНЖ5-1 and German silver. Durability of matrices/dies of steel ЭИ787 between the regrindings is 4-10 times higher than matrices/dies made of steel 3X2B8Ф. This gives grounds to recommend the use/application of steel ЭИ787 for the extrusion/pressing of the alloys indicated on the press by effort/force 3000 t.

Further work on increase in durability of matrices/dies made of steel ЭИ787 must be directed toward setting of optimum modes/conditions of heat treatment.

Alloy ЭИ867.

Alloy ЭИ867 - alloyed nickel-chromium alloy with additives of aluminum, tungsten, molybdenum and cobalt, that has high mechanical properties with 800-950°C. After continuous operation at temperatures of higher than 950°C this alloy somewhat is softened.

During testing of dies made from alloy ЭИ867 on containers with diameter 155, 180, 306 mm of presses effort/force 1500 and 3000 t

obtained best results. Durability between the regrindings of the matrices/dies with an outside diameter of 250 mm the extrusion/pressing the ducts/tubes/pipes with a diameter of 160×174, 140×153 and 160×180 mm of the alloy MHЖ5-1 comprised to 100-150 molding cycles. Virtually the extrusion/pressing all batches of ducts/tubes/pipes was produced without servicing of matrices/dies. At present matrices/dies maintained/withstood from 400 to 650 molding cycles. Radial cracks appear at the surface of matrices/dies after 30-50 molding cycles, but subsequently they do not increase, they remain very thin and do not create defects/flaws on the surface of molded articles (Fig. 2).

Analogous matrices/dies made of steel 3X2B8Ф have durability of 5-8 molding cycles, after which working eyelet of matrix/die swims in and it must be bored.

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Alloy ЭИ437БУ.

From alloy ЭИ437БУ for container with diameter of 408 mm of press effort/force 3000 t manufactured matrices/dies with sizes/dimensions diam. 365/diam. 289×70 mm for extrusion/pressing of ducts/tubes/pipes from alloy MHЖ5-1 and copper. These matrices/dies

maintained/withstood without regrinding 97 and 124 molding cycles. On the working part of the matrices/dies arose smal round, but there are no cracks, and matrices/dies can be utilized for further work.

Since cost/value of alloy ЭИ437БУ is comparatively low, its use/application for manufacturing matrices/dies of container with diameter of 408 mm is promising.

Conclusions/derivations.

1. Matrices/dies for hot pressing of alloys on copper basis (such as МНЖ5-1 and German silver), manufactured from steel of type 3Х2В8Ф, they possess very low durability and do not satisfy contemporary requirements.

2. It is expedient to apply steel ЭИ787 for manufacturing dies for extrusion/pressing of copper, German silver, alloy МНЖ5-1 at specific pressures on matrix/die to 40 kgf/mm², at temperature of extrusion/pressing to 950°C.

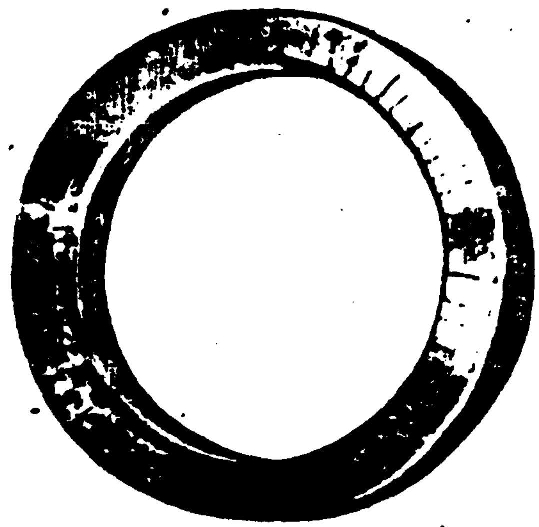

Fig. 2. Matrix/die diam. 250/189×65 from the alloy ЭИ867 after 650 molding cycles of ducts/tubes/pipes from the alloy МНЖ5-1.

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3. Alloy ЭИ867 is general-purpose alloy for manufacturing matrices/dies, many times raising their durability and service life.

4. Alloy ЭИ437БУ, used for manufacturing matrices/dies, it showed high results with work on container with diameter of 408 mm of press by effort/force 3000 t with extrusion/pressing of ducts/tubes/pipes from alloy МНЖ5-1 and copper.

5. Use of high-temperature (strength) alloys for manufacturing matrices/dies provides increase in productivity during extrusion/pressing and output/yield of suitable, increase in durability of die-holders and other indices.

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MODERNIZATION OF HYDRAULIC PRESSES.

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For increase in labor productivity at Kamensk-Ural plant on working of nonferrous metals work on modernization of hydraulic presses is carried out.

During operation working ram area undergoes cavitation, abrasive and corrosive wear.

As a result of cavitation and corrosive decomposition of internal surface of hydraulic system in cotton gasket packing particles of destroyed metal and oxides, brought by water, are introduced. This leads to formation on the ram area, which have insufficient hardness, deep longitudinal ones, marks/scratches/grooves, which worsen/impair hermetic sealing/pressurization of sealing/packing/compaction and accelerating wear mating members.

For preservation of working ram area from wear of all forms was used facing of plungers by anticavitation stainless self-hardening steel of type 25X9Г9CT.

Surfacing was accomplished/realized by powder wire of brand/mark ПП25X9Г9CT under layer of flux AH348. For the surfacing of large/coarse plungers was utilized the lathe, to which was adapted fused head. Machining is performed on the same machine tool. The surfacing of fine/small plungers was accomplished/realized in the fused department/separation of repair and mechanical shop on the fused automatic machine ABC.

Characteristic feature of steel 25X9Г9CT is its ability to self-harden. During the plastic deformation of this steel the strain/work hardening surface layer proceeds not only from the work hardening/peening, but as a result of the phase transformations.

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After surfacing hardness of layer comprises not more than 30 units HR_c, and it is completely available for common machining by cutter, which ensures finish of surface of 4th class.

After rolling hardness of steel layer is raised by roller to

50-55 units HR_c and somewhat is improved surface. In the process of the work of plunger in the press the quality of surface continuously is raised, reaching 12-13th class (mirror).

As a result of applying steel of brand/mark 25X9Г9CT durability of plungers it was raised approximately/exemplarily 10 times.

Good surface condition of plungers contributed to increase in durability of bronze bushings 6 times, thanks to which they were reduced by simple of presses with interruption of gaskets. Earlier durability of gaskets was on the average of 3-4 months, at present it is 1.5-2.0 years.

Improvement in quality of ram area made possible to use as stuffing-box seal polyserial rubber-fabric sealing/packing/compaction of type "Chevron". As a result of using the packing of the type "Chevron" instead of the cotton packing with the rubber nucleus was reduced the time to the interruption of gaskets, more reliable stuffing-boxs seal were created.

Restorations to surfacing were subjected also housing of distributors and prefill valves. In connection with the fact that during the operation the valve seats of distributors and prefill valves undergo cavitation and corrosive wear, data of part it was

necessary frequently to replace. Furthermore, the wear of housing adversely affected the work of presses. For an increase in the service life of these parts the valve seats after the appropriate machining were subjected to surfacing by the noncorrosive electrodes ЭНТУ-3.

Surfacing was produced by hand or on fused automatic machine. After surfacing the valve seats of housing were worked to the necessary sizes/dimensions in the usual way. Implementation of surfacing made possible to increase the service life of housing on the average 3-4 times.

For shortening of time to replacement of press instrument point of attachment of cotter pin was reconstructed.

New construction/design of point of attachment of cotter pin resembles construction/design of cannon gate/shutter and consists of three-detent bushing, which enters into engagement with three canine teeth, welded into ring of plunger-holder. For the attachment of cotter key it is necessary to insert into the ring of plunger-holder and to turn only to 1/3 revolutions.

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Feed unit of control dummy blocks on light presses is manufactured. It is the pneumatic cylinder, which is established/installed from end-face of container holder and is fastened to the column with the aid of the clamp. In the cylinder is placed the piston with the stock/rod, to end of which is fastened the prism for holding of control dummy block. Control dummy block is supplied to the prism on the chute.

Work on mechanization of supply of ingots and working dummy blocks to axis/axle of press is carried out. Barely effective, unreliable in the work and bulky mechanisms of the type "mechanical arm" were replaced by new, more compact mechanisms.

Construction/design of new mechanism is truck, which is moved along rail track from electric motor, established/installed on it. On the truck is assembled the arrow/pointer, at end of which is established/installed swivel head for the turn of ingot on 90° in parallel to the axis/axle of press, led to the rotation by pneumatic cylinder. Arrow/pointer with the aid of the pneumatic cylinder can be built up and lowered. Mechanism works as follows: when truck will move away to rear end position, one dummy block overhangs by feed unit of working dummy blocks to swivel head. Worker from the furnace to swivel head simultaneously rolls ingot. After this the truck is moved to the press.

During traverse to press arrow/pointer is built up and occurs turn of ingot on 90°. When cotter pin moves ingot into the container to the specific length, truck will move away from the press to end rear position.

Withdrawal of truck from press, transmission/delivery of working dummy blocks, lift of arrow/pointer and turn of head are accomplished/realized automatically.

As a result of implementing new mechanisms working conditions of workers are facilitated, expenditures for repair are lowered and are reduced idle times of presses.

One of most difficult measures was mechanization of supply of ingots and working dummy blocks to axis/axle of press effort/force 3500 t. At the plant the new diagram of the supply of ingots and working dummy blocks to the axis/axle of press is developed.

Feed unit of ingots and dummy blocks consists of gravitational roller conveyor/roller train with pneumatic shock-proofed system in section of indentation of ingots of furnace, device for rotation of ingot and supply of dummy blocks and telescopic inclined feeder of

ingot and dummy block to axis/axle of press.

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Ingot is rolled from furnace to roller conveyor/roller train and it moves with gravity of dead weight to swivel gear. On the groove of swivel gear the ingot is transported to the prism of feeder, where working washer simultaneously is supplied.

As a result of implementing measures indicated for modernization and mechanization of hydraulic presses technical and economic indices of work of plant were raised.

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